THE CLASSIFICATION OF THE BLACK OAKS.

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(*Read April 19, 1912.*)

(Plates X–XIII.)

Since Alphonse de Candolle[1] pointed out that the abortive ovules occupy a definite position in a mature acorn, constantly basal or nearly so in some species and as constantly apical or nearly so in others, and crystallized the knowledge that the ripening of the fruit occurs in one season in some and requires two seasons in others (attending correspondingly retarded fertilization[2]) with as great constancy,[3] so many other correlations in wood, bark, leaf, stamens and styles have been associated with these differences that the white oak and black oak groups[4] have long been recognized as presenting a natural division of our native species: the former with basal ovules, short styles with dilated stigmas, usually annual often stalked fruit essentially glabrous within and often with tuberculate or aristate cupule-scales, leaf lobes not bristle-tipped, pale often flaky bark and tough compact rather pale wood of slow growth; the latter with apical ovules, elongated slender styles, usually biennial nearly sessile fruit tomentose within and rarely with tuberculate or tapered cupule-scales, bristle-pointed leaf lobes, dark often deeply checked but not flaking bark and darker wood of twice as rapid growth on the average.

The principal doubts as to the sufficiency of these group characters may be said to rest on an occasional easily understandable but none-the-less misleading slip of the pen such as that of de Candolle's

[1] A. de Candolle, *Ann. Sci. Nat.*, Bot., IV., **18**: 51. 1862. For various other places of publication in French and English, reference may be made to the catalogue of the Royal Society.

[2] Conrad, *Bot. Gaz.*, **29**: 410. 1900.

[3] A. de Candolle, *l. c.*, 50.

[4] Engelmann, *Trans. Acad. Sci. of St. Louis*, **3**: 374, 381, 388. 1876–7; "Bot. Works," 390, 394, 397.

translator[5] and of Professor Sargent,[6] making the ovules appear to be basal in the black oaks; and on puzzling facts as well as observations on the dwarf live oaks, particularly *Q. Emoryi* which Engelmann[7] and Greene[8] have treated as a black oak on its general assemblage of characters, and Sargent[9] (as did Engelmann[10] at first) places with the white oaks because of its basal ovules.

Without attempting a critical analysis of hybrids, segregates and aberrants, the present communication offers what appears to be a natural grouping of our black oaks, which have been arranged in floras and monographs usually and diversely in sequence dictated by convenience of foliage contrast—that is, descriptively rather than taxonomically.

The classification here proposed was adopted some months since when the oaks growing about St. Louis were selected to illustrate to a university class the synthesis of generic concepts out of specific characters. This local flora is fairly rich in representation of *Quercus,* for its dozen species constitute about two-thirds of those of Missouri, half of those of the northeastern states, a fourth of those of the United States, and a twentieth of those of the world. For this reason it has been comparatively easy to extend the conclusions based on the local species so as to embrace all of those occurring east of the great plains—which are evidently of a common stock. The few species occurring between the continental divide and the desert, and the few found west of this natural barrier, appear to represent groups more properly coördinated with the entire assemblage of eastern species than with the sets into which this is divided. In them, perhaps, is to be found the key to an understanding of the history of the genus as it is now represented in North America.

Not many words are needed to indicate the striking collective differences in bud and fruit between the three groups, black oaks, scarlet oaks and swamp oaks of the eastern states, as pictured in the accom-

[5] A. de Candolle, *Trans. Edinburgh Bot. Soc.,* 7: 440. 1863.
[6] Sargent, "Manual, Trees of N. A.," 227. 1905.
[7] Engelmann, *l. c.,* 388, 394.
[8] Greene, "Ill. of W. A. Oaks," 45. 1889.
[9] Sargent, *l. c.,* 230, 286.
[10] Engelmann, *l. c.,* 381–2.

panying plates: the first (Pl. X.) with large hairy buds and rather large fruit with coarse cup-scales, the second (Pl. XI.) with medium-sized nearly smooth buds and moderate or large fruit with rather closer or finer scales, and the third (Pl. XII.) with still smaller buds and acorns, these with still closer and finer cupule-scales. That the groups are closely allied is to be expected, and in bud and cup characters *Q. coccinea* connects the first two; but a glance at the plates will show how distinct the collective impression produced by each group is, and how far from natural it is to place *Q. marilandica* (Pl. X., f. 1) next *Q. nigra* (Pl. XII., f. 2) because of a comparability in leaf shape that has worked mischief in the names both have borne, or *Q. palustris* (Pl. XII., f. 1) next *Q. rubra* (Pl. XI., f. 5) or *Q. velutina* (Pl. X., f. 4), or to separate *Q. Catesbæi* (Pl. X., f. 2) far from *Q. digitata* (Pl. X., f. 3) or even *Q. marilandica*, as is commonly done. An interesting feature in the cup of these latter species is that the scales are inflexed around its margin—commonly in the first, occasionally in the others—a character to be connected with Engelmann's observation[11] that the tips of the leaf lobes are bent in in vernation in *Catesbæi*, though it is not absolutely limited to them.

Though homogeneous in external bud and fruit characters, the group of swamp oaks is subdivisible into a series with broad-lobed leaves, the water oaks, in which the leaves are flatly imbricated in the bud as in the black and scarlet oaks, and a series with narrow entire leaves, the willow oaks, in which the leaves are revolute in the bud—strongly so in *Q. imbricaria, Q. Phellos, Q. laurifolia* and *Q. pumila;* less rolled in *Q. cinerea* and *Q. myrtifolia*, and thus approaching the western groups, though the fruits of the two are very different. Such Mexican bristle-leaved oaks as *Q. Grabami* are evidently of this general stock.

Grouped primarily according to the characters here selected rather than leaf form, these oaks fall into line as follows:

Black Oaks.

Quercus marilandica (black jack).

Quercus Catesbæi (turkey oak).

[11] Engelmann, *l. c.*, 376.

Quercus digitata (Spanish oak).
Quercus velutina (quercitron).

Scarlet Oaks.

Quercus coccinea (scarlet oak).
Quercus ellipsoidalis (Hill's oak).
Quercus rubra (red oak).
Quercus texana (Texas red oak).
Quercus nana (bear oak).

Swamp Oaks.

Water oaks.

Quercus palustris (pin oak).
Quercus nigra (water oak).
Quercus georgiana (Stone Mountain oak).

Willow oaks.

Quercus imbricaria (shingle oak).
Quercus Phellos (willow oak).
Quercus laurifolia (laurel oak).
Quercus pumila (running oak).
Quercus brevifolia (cinnamon oak).
Quercus myrtifolia (myrtle oak).

Olive Oaks.

Quercus hypoleuca (white-leaf oak).
Quercus Emoryi (Emory's oak).

Holly Oaks.

Quercus agrifolia (evergreen oak).
Quercus Wislizeni (highland oak).
Quercus californica (Kellogg's oak).

EXPLANATION OF PLATES.

In all, the buds are enlarged three diameters, and the acorns and cupules are of natural size. No special care has been taken in the selection of material, except to get mature winter buds because the differences are less evident while they are developing, and to pick out average fruits from the varying assemblage presented by each species.

PLATE X. BLACK OAKS.—1, *Quercus marilandica;* 2, *Q. Catesbæi;* 3, *Q. digitata;* 4, *Q. velutina.*

PLATE XI. SCARLET OAKS.—1, *Quercus coccinea;* 2, *Q. ellipsoidalis;* 3, *Q. texana* (the northern form known also as *Q. Schneckii*); 4, *Q. texana* (from Texas); 5, *Q. rubra;* 6, *Q. nana.*

PLATE XII. SWAMP OAKS.—Water Oaks: 1, *Quercus palustris;* 2, *Q. nigra;* 3, *Q. georgiana.* Willow Oaks: 4, *Quercus imbricaria;* 5, *Q. Phellos;* 6. *Q. laurifolia;* 7, *Q. pumila;* 8, *Q. brevifolia;* 9, *Q. myrtifolia.*

PLATE XIII. WESTERN BLACK OAKS.—Olive Oaks: 1, *Quercus hypoleuca;* 2, *Q. Emoryi.* Holly Oaks: 3, *Quercus agrifolia;* 4, *Q. Wislizeni;* 5, *Q. californica.*